THE CENTRAL AFRICAN JOURNAL OF MEDICINE

Vol. 40, No. 11 CONTENTS November, 1994

ORIGINAL ARTICLES

CASE REPORTS

SUPPORTED BY CIMAS MEDICAL AID SOCIETY

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Plasma cholesterol distribution in a rural Nigerian population — relationship to age, sex and body mass

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SUMMARY

Plasma cholesterol was measured in 417 healthy rural Nigerians consisting of 230 males (mean age 36,60 ± 1,29 years) and 187 (mean age 34,60 ± 1,38 years). Mean plasma cholesterol concentrations were found to be 2,91 ± 0,22 mmol/l and 3,26 ± 0,25 mmol/l in males and females respectively. These differences were highly significant ($p<0,025$). The lowest plasma cholesterol levels were observed in the 11 to 20 year age group and the highest in the >61 years age group. A strong correlation, which was higher in males than females was observed between plasma cholesterol and age ($r \geq 0,48$; $p<0,01$). No significant correlation was observed between body mass index (BMI) and plasma cholesterol in both male female subjects.

These results suggest that plasma cholesterol concentrations observed in rural Nigerians may be related to their physical activity and the consumption of a low fat diet.

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INTRODUCTION

Several reports indicate the close relationship between high plasma cholesterol levels with the occurrence of atherosclerosis.[1,2] The prevalence of atherosclerosis has been reported to be much higher in Caucasians than in Black Africans.[3] Large differences in total plasma cholesterol levels between these populations have been reported and have been attributed to differing dietary patterns between them.[4–7] Thus data on the distribution of cholesterol in groups of subjects randomly selected from communities are important since they provide opportunities for intra and international comparisons which may thus lead to identification of habits or traits which influence plasma cholesterol levels.

There have been several reports on the pattern of plasma cholesterol in urban Nigerians.[4,5,7,8] These reports suggest that differences exist in the plasma cholesterol levels of Nigerians in the low and high socio-economic income groups.[4,9] Indeed some studies from Nigeria reported that although the mean plasma cholesterol levels are much lower in Nigerians than in Caucasians, Nigerians in the high income group tend to have similar plasma cholesterol levels to their Western counterparts.[9,10] However, the distribution of plasma cholesterol amongst Nigerians residing in rural areas where the majority of Nigerians reside, has not been extensively studied. This paper reports on the distribution of plasma cholesterol concentrations in a healthy Nigerian rural population and in addition, examines the relation-ship of plasma cholesterol to age, sex and body mass.

MATERIALS AND METHODS

Subjects: 500 subjects aged 11 to 95 years were recruited from one of the rural villages near Ilorin, Nigeria. Admission into the study was voluntary and consent was obtained from each subject. The subjects represented the major age groups in the village (except for subjects under the age of 10 years). Each subject underwent a thorough medical examination and was screened with biochemical tests to eliminate subjects with various diseases such as *Diabetes mellitus*, liver disease and uraemia. Subjects were also screened for hypertension (blood pressure ≥ 140/90 mmg Hg) to exclude hypertensives from the study. Each volunteer was questioned intensively about their socio-economic status, dietary and exercise schedule. The screening left us with 417 subjects.

Physical exercise and diet: The majority of the subjects were farmers who engaged in daily exercise by virtue of their daily subsistence activities and trekked about five kms daily. The average annual income of the subjects was less than N1,500. Using 24 hour dietary recall data, the diet of the majority of subjects (99 pc) was found to consist of yam, cassava, maize with legumes, vegetables and fruits (high carbohydrate, low fat, low protein). Milk and eggs were hardly consumed while meat was eaten only on special occasions.

Procedures: The height of each subject was measured with the subject standing direct and looking straight ahead (without shoes). Body weight was measures using a portable weighing scale (Hanson, Sweden). Each subject was weighed with the minimum of clothing. Blood pressure of each subject was measured in the semi-supine (sitting) position after 10 minutes of rest using an Accouson sphygmomanometer.

Blood was collected between 0800 and 1000 hours from fasting subjects into (a) plain tubes for cholesterol and (b) tubes containing fluoride oxalate for glucose analysis. The serum was separated within two hours of collection. Samples were stored at –20°C until analysis. Cholesterol was measured by the method of Abell using Lieberman Burchard reagent[11] and glucose by the method of Trinder.[12] Quality control was assessed by including control sera (Precinon L, Boehringer, W, Germany) in the assays. Body Mass Index (BMI) was calculated by dividing the body weight (kg) by the square of the height (M^2).

Statistical analysis: Student's test was used for statistical comparison of the means of various parameters. Correlation coefficients (r) were determined to examine the linear relationship between plasma cholesterol and age and body mass index.

RESULTS

The distribution of age, sex and body mass index (BMI) are shown in Table I. There was a total of 417 subjects consisting of 230 (55,2 pc) males and 187 (44,8 pc) females. Subjects under the age of 20 years formed the largest group (32,6 pc). Female subjects were generally heavier than males though this was not statistically significant.

Table I: Age, sex and body mass distribution of subjects.

Age group	pc	Sex	No.	Age	BMI
11–20	32,6	M	77	17,14 ± 0,30	18,50 ± 0,24
(136)		F	59	16,1 ± 0,26	19,58 ± 0,35
21–30		M	37	25,2 ± 0,37	19,90 ± 0,26
(62)	14,9	F	25	25,3 ± 0,46	21,60 ± 0,5
31–40		M	28	33,9 ± 0,64	20,30 ± 0,42
(56)	13,4	F	28	34,6 ± 0,60	21,00 ± 0,45
41–50		M	30	46,8 ± 0,53	19,60 ± 0,39
(55)	13,2	F	25	41,1 ± 0,62	20,60 ± 0,58
51–60		M	26	54,1 ± 0,61	20,0 ± 0,43
(51)	12,2	F	25	56,4 ± 0,56	20,70 ± 0,62
≥61		M	32	71,0 ± 1,70	19,30 ± 0,38
(57)	13,2	F	25	70,6 ± 1,70	20,70 ± 0,42
Total		M	230	36,60 ± 1,29	19,15 ± 0,36
(417)	100	F	187	34,60 ± 1,38	20,24 ± 0,49

Table II summarises the results of the total plasma cholesterol in male and female subjects of each age. Plasma cholesterol concentrations increased with age in both sexes, the lowest level being observed in the 11 to 20 age group and the highest in the ≥61 years age group. Plasma cholesterol concentrations were higher in female than male subjects in each age group but were of significance only in the 11 to 20, 21 to 30, 31 to 40 and 41 to 50 age groups ($p<0,025$).

Table II: Distribution of plasma cholesterol (±sem).

Age group	Sex	Chol	Sem	Range	p
11–20	M	2,58	0,12	1,5–5,4	
	F	2,88	0,15	1,5–5,2	<0,025
21–30	M	2,74	0,18	1,5–5,7	
	F	3,21	0,26	2,1–6,8	<0,025
31–40	M	2,73	0,14	1,5–4,5	
	F	3,32	0,21	1,6–5,7	<0,01
41–50	M	2,84	0,26	1,7–6,5	
	F	3,35	0,34	1,6–6,5	<0,025
51–60	M	3,2	0,25	1,6–6,3	
	F	3,39	0,31	1,6–6,3	NS
–60	M	3,36	0,32	1,5–6,5	
	F	3,38	0,21	1,7–5,4	NS
Total	M	2,91	0,22	1,5–6,5	
	F	3,26	0,25	1,5–6,8	<0,028

p values represent differences between males and females of each age group.

A strong correlation between age and plasma cholesterol was observed ($r = 0,48$; $p<0,01$). This correlation was higher in male ($r = 0,7$; $p<0,01$) than female subjects ($r = 0,2$; $p<0,05$). No significant correlation was observed between body mass index (BMI) and plasma cholesterol levels in both male and female subjects respectively (Table III).

Table III: Correlation between plasma cholesterol, age and body mass.

	Age		Body Mass	
	Males	Females	Males	Females
Cholesterol (r)*	0,7	0,2	0,08	0,01
p	< 0,01	< 0,05	NS	NS

r represents the correlation coefficient.

DISCUSSION

The result of the present study indicate that plasma cholesterol concentrations in rural Nigerians are much lower than values reported for urban Nigerians.[4,7–10,13] Taylor and Agbadana[9] also reported lower concentrations of plasma cholesterol in rural than urban Nigerians of similar age and sex. Our results, though lower, are also similar to those reported in rural South Africans[14] The lower plasma cholesterol levels observed in rural Nigerians may be due to differing dietary patterns between rural and urban Nigerians. It has been reported that many urban Nigerians have abandoned the traditional diets and have adopted 'western' style diets.[15] In addition, the degree of physical activity may also play an important role.[14] In our study, more than 90 pc of our survey sample consumed a diet which consisted exclusively of carbohydrates and vegetables with virtually no animal fats. In addition, they engaged in daily physical exercise (farming) and trekked an average of five km daily.

The results of this study suggest that age and sex may be the two most important factors influencing plasma cholesterol in the rural Nigerian. Though this has also been observed in urban Nigerians, a firm relationship has not been established.[5,7,8] Body mass did not appear to influence plasma cholesterol levels. Our observations are similar to those reported in northern Nigerians and Black South Africans.[5,16] Body mass as well as age and sex have been reported as influencing plasma cholesterol concentrations in other races.[17,18]

When comparing our results to healthy Caucasians of similar age and sex, plasma cholesterol concentrations were observed to be almost half in values to those reported in Caucasians.[17,19] It is now well recognised that hypercholesterolinaemia is one of the most significant biochemical risk factors associated with coronary heart disease.[2] Coronary heart disease is now one of the major causes of mortality and morbidity in Caucasian populations.[1,3,19] Genetic as well as dietary factors have been implicated in the pathogenesis of coronary heart disease.[1,2] It is probable that the low incidence of coronary heart disease reported in Nigerians and other Black Africans[3] may be related to their low plasma cholesterol levels. In recent times an increased incidence of ischaemic heart disease has been reported in the middle class populations of Kenya and has been attributed to the adoption of a 'western' style diet and inadequate physical activity.[20] In Nigeria, where rapid urbanisation has recently taken place[21] it may be appropriate to initiate programmes which will advise the public on diet and the beneficial effect of exercise. This may be instrumental in preventing the introduction of a pathological state, which hitherto has virtually been unknown in Nigeria.

ACKNOWLEDGEMENTS

We wish to thank Mrs Madeline Oakiva for typing the manuscript. This work was supported by the University of Ilorin Senate Research Grant 1986/1987.

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